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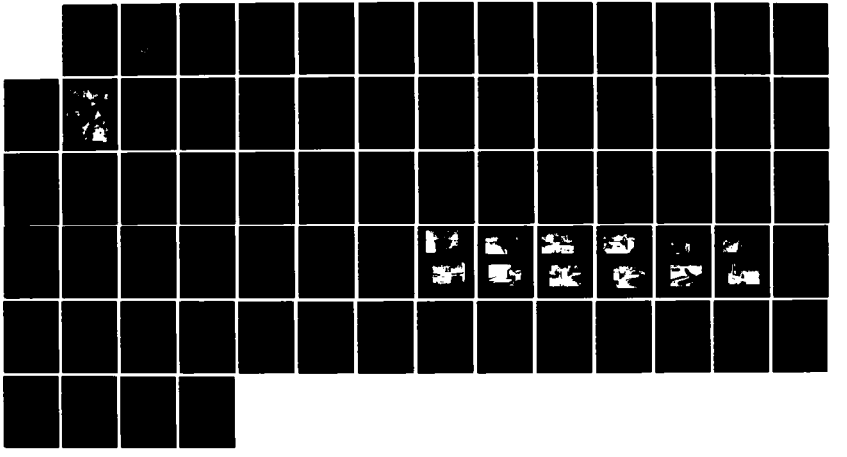

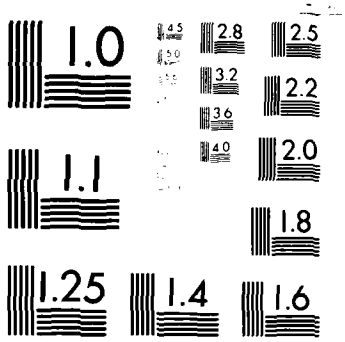

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AD-A156 384

PISCATAQUA RIVER BASIN

WAKEFIELD, NEW HAMPSHIRE

GREAT EAST LAKE DAM

NH 00111

NHWRB NO. 241.14

PHASE I INSPECTION REPORT
NATIONAL DAM INSPECTION PROGRAM

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Cover program reads: Phase I Inspection Report, National Dam Inspection Program; however, the official title of the program is: National Program for Inspection of Non-Federal Dams; use cover date for date of report.

19. KEY WORDS (Continue on reverse side if necessary and identify by block number)

DAMS, INSPECTION, DAM SAFETY,

Piscataqua RIver Basin
Wakefield New Hampshire
Salmon Falls River

20 ABSTRACT (Continue on reverse side if necessary and identify by block number)

THe dam is a 68 ft. long, 15 ft. high composite structure consisting of stone and concrete. The dam is in excellent condition, based on the visual inspection. It is intermediate in size with a significant hazard potential classification. It is recommended that the owner engage a qualified engineer to evaluate further the potential for overtopping and the inadequacy of the spillway.

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REPLY TO
ATTENTION OF:

NEDED

APR 12 1979

Honorable Hugh J. Gallen
Governor of the State of New Hampshire
State House
Concord, New Hampshire 03301

Dear Governor Gallen:

I am forwarding to you a copy of the Great East Lake Dam Phase I Inspection Report, which was prepared under the National Program for Inspection of Non-Federal Dams. This report is presented for your use and is based upon a visual inspection, a review of the past performance and a brief hydrological study of the dam. A brief assessment is included at the beginning of the report. I have approved the report and support the findings and recommendations described in Section 7 and ask that you keep me informed of the actions taken to implement them. This follow-up action is a vitally important part of this program.

A copy of this report has been forwarded to the Water Resources Board, the cooperating agency for the State of New Hampshire. In addition, a copy of the report has also been furnished the owner, New Hampshire Water Resources Board, 37 Pleasant Street, Concord, New Hampshire 03301, ATTN: Mr. George M. McGee, Sr., Chairman.

Copies of this report will be made available to the public, upon request, by this office under the Freedom of Information Act. In the case of this report the release date will be thirty days from the date of this letter.

I wish to take this opportunity to thank you and the Water Resources Board for your cooperation in carrying out this program.

Sincerely yours,

JOHN P. CHANDLER
Colonel, Corps of Engineers
Division Engineer

Incl
As stated

GREAT EAST LAKE DAM

NH 00111

NHWRB 241.14

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PISCATAQUA RIVER BASIN
WAKEFIELD, NEW HAMPSHIRE

PHASE I INSPECTION REPORT
NATIONAL DAM INSPECTION PROGRAM

LETTER OF TRANSMITTAL

FROM THE CORPS OF ENGINEERS TO THE STATE

TO BE SUPPLIED BY THE CORPS OF ENGINEERS

NATIONAL DAM INSPECTION PROGRAM
PHASE I - INSPECTION REPORT
BRIEF ASSESSMENT

Identification No.: 00111

Name of Dam: Great East Lake Dam

Town: Wakefield

County and State: Carroll, New Hampshire

Stream: Salmon Falls River

Date of Inspection: November 16, 1978

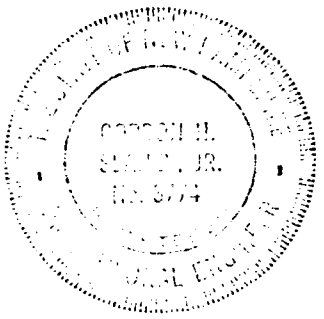
Great East Lake Dam is a 68 foot long, 15 foot high composite structure consisting of stone and concrete. This dam, originally constructed in about 1825, was reconstructed by the New Hampshire Water Resources Board in 1972. The present dam has a vertical concrete wall at the upstream face and two spillway sections, one section on each side of the outlet works structure. The outlet works consists of a six foot wide sluiceway regulated by a mechanically operated gate. Engineering data available consisted of several sketches and past inspection reports. No construction data or design calculations were available.

The visual inspection indicated that, from the geotechnical and structural standpoints, the dam is in excellent condition. The inspection did reveal, however, minor bulging and misalignment of the vertical, dry-masonry walls on the sides of the discharge channel.

Based on the dam's intermediate size and significant hazard classification in accordance with the Corps guidelines, the test flood is one-half the PMF. The spillway will pass only about 39 percent of the test flood and is considered inadequate. Under test flood conditions, the dam would be overtopped by approximately 1.5 feet.

It is recommended that the owner engage a qualified engineer to evaluate further the potential for overtopping and the inadequacy of the spillway. Also, provisions should be made by the owner to inspect the condition of the vertical, dry-masonry walls on the sides of the discharge channel from the dam to Canal Road at least once a year and make repairs when needed.

The recommendation and remedial measures are described in Section 7 and should be addressed within two years after receipt of this Phase I - Inspection Report by the owner.



Gordon H. Slaney, Jr.

Gordon H. Slaney, Jr., P.E.
Project Engineer

Howard, Needles, Tammen & Bergendoff
Boston, Massachusetts

This Phase I Inspection Report on Great East Lake Dam has been reviewed by the undersigned Review Board members. In our opinion, the reported findings, conclusions, and recommendations are consistent with the Recommended Guidelines for Safety Inspection of Dams, and with good engineering judgment and practice, and is hereby submitted for approval.

JOSEPH W. FINEGAN, JR., MEMBER
Water Control Branch
Engineering Division

CARNEY M. TERZIAN, MEMBER
Design Branch
Engineering Division

JOSEPH A. MCELROY, CHAIRMAN
Chief, NED Materials Testing Lab.
Foundations & Materials Branch
Engineering Division

APPROVAL RECOMMENDED:

JOE R. CRAIN
Chief, Engineering Division

PREFACE

This report is prepared under guidance contained in the Recommended Guidelines for Safety Inspection of Dams, for Phase I Investigations. Copies of these guidelines may be obtained from the Office of Chief of Engineers, Washington, D.C. 20314. The purpose of a Phase I Investigation is to identify expeditiously those dams which may pose hazards to human life or property. The assessment of the general condition of the dam is based upon available data and visual inspections. Detailed investigation and analyses involving topographic mapping, subsurface investigations, testing and detailed computational evaluations are beyond the scope of a Phase I Investigation; however, the investigation is intended to identify any need for such studies.

In reviewing this report, it should be realized that the reported condition of the dam is based on observations of field conditions at the time of inspection along with data available to the inspection team. In cases where the reservoir was lowered or drained prior to inspection, such action, while improving the stability and safety of the dam, removes the normal load on the structure and may obscure certain conditions which might otherwise be detectable if inspected under the normal operating environment of the structure.

It is important to note that the condition of a dam depends on numerous and constantly changing internal and external conditions, and is evolutionary in nature. It would be incorrect to assume that the present condition of the dam will continue to represent the condition of the dam at some point in the future. Only through continued care and inspection can there by any chance that unsafe conditions be detected.

Phase I inspections are not intended to provide detailed hydrologic and hydraulic analyses. In accordance with the established Guidelines, the Spillway Test Flood is based on the estimated "Probable Maximum Flood" for the region (greatest reasonably possible storm runoff), or fractions thereof. Because of the magnitude and rarity of such a storm event, a finding that a spillway will not pass the test flood should not be interpreted as necessarily posing a highly inadequate condition. The test flood provides a measure of relative spillway capacity and serves as an aide in determining the need for more detailed hydrologic and hydraulic studies, considering the size of the dam, its general condition and the downstream damage potential.

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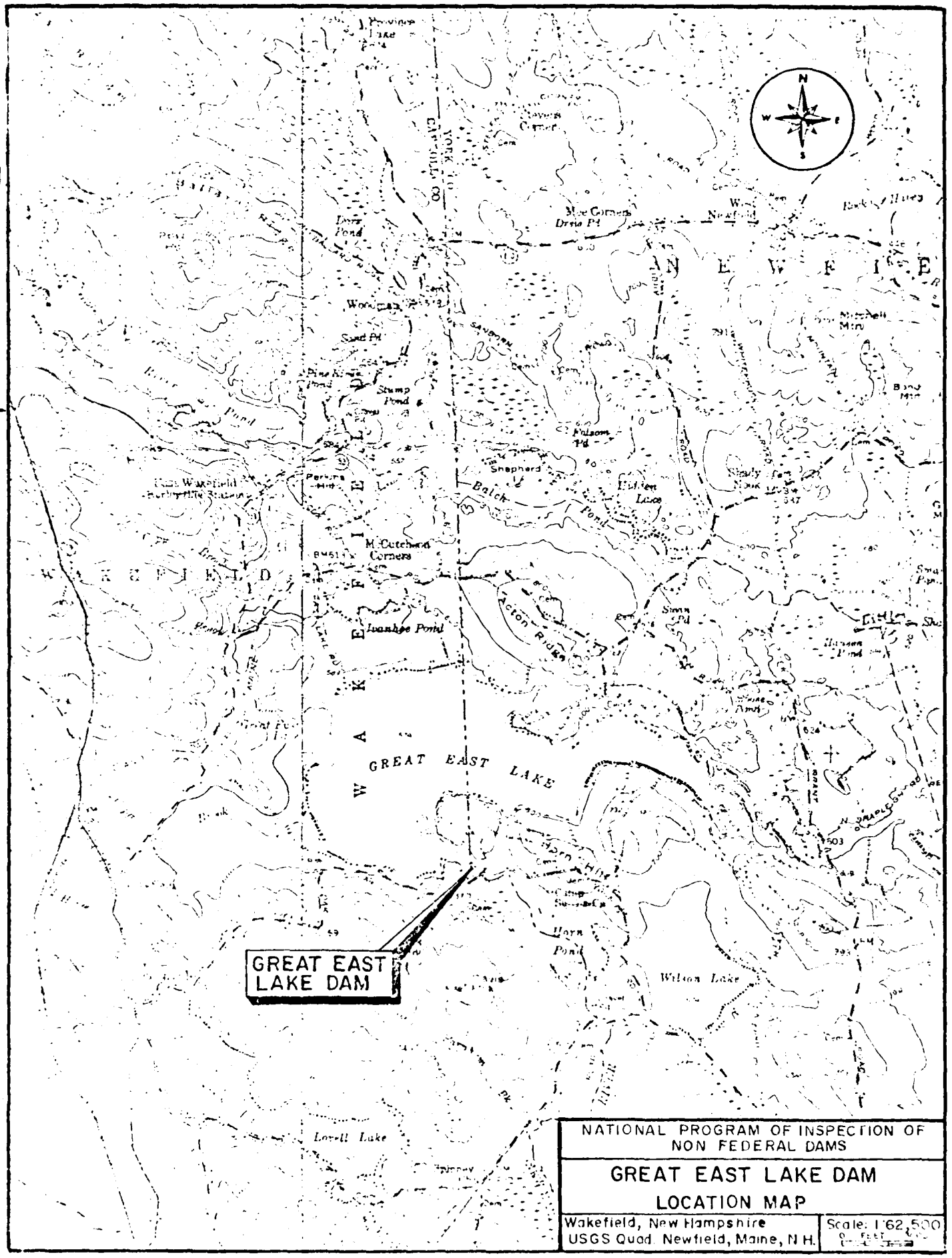


NATIONAL PROGRAM OF INSPECTION OF NON FEDERAL DAMS

GREAT EAST LAKE DAM

LOCATION MAP

Wakefield, New Hampshire
USGS Quad. Newfield, Maine, N.H.

Scale: 1:62,500
0 1 Feet

NATIONAL DAM INSPECTION PROGRAM
PHASE I INSPECTION REPORT
GREAT EAST LAKE DAM

SECTION 1
PROJECT INFORMATION

1.1 General

a. Authority. Public Law 92-367, August 8, 1972, authorized the Secretary of the Army, through the Corps of Engineers, to initiate a National Program of Dam Inspection throughout the United States. The New England Division of the Corps of Engineers has been assigned the responsibility of supervising the inspection of dams within the New England Region. Howard, Needles, Tammen & Bergendoff has been retained by the New England Division to inspect and report on selected dams in the State of New Hampshire. Authorization and notice to proceed were issued to Howard, Needles, Tammen & Bergendoff under a letter of October 23, 1978, from John P. Chandler, Colonel, Corps of Engineers. Contract No. DACW33-78-C-0356 has been assigned by the Corps of Engineers for this work.

b. Purpose

(1) To perform technical inspection and evaluation of non-Federal dams to identify conditions which threaten the public safety and thus permit correction in a timely manner by non-Federal interests.

(2) To encourage and prepare the states to initiate quickly effective dam safety programs for non-Federal dams.

(3) To update, verify and complete the National Inventory of Dams.

1.2 Description of Project

a. Location. Great East Lake Dam is located on the Salmon Falls River approximately 5.3 miles upstream of Milton Mills, New Hampshire, across the Maine-New Hampshire State line in Wakefield, New Hampshire and Newfield, Maine. The dam is shown on U.S.G.S. Quadrangle Newfield, Maine-New Hampshire with coordinates approximately N43°34'06", W70°58'30" Carroll County, New Hampshire, York County, Maine. The location of Great East Lake Dam is shown on the Location Map immediately preceding this page.

b. Descrition of Dam and Appurtenances. Great East Lake Dam is a composite structure, approximately 68 feet long, consisting of stone and concrete. The maximum structural height of the dam, according to field measurement, is about 15 feet measured from the base to the top of the concrete wall. This dam, originally constructed in about 1825, was reconstructed by the New Hampshire Water Resources Board in 1972. The present dam has a vertical concrete wall at the upstream face and two spillway sections, one section on each side of the outlet works structure.

The appurtenant structures consist of a spillway with flash boards, outlet works structure consisting of sluiceway with wooden gate, concrete block gate house, service deck and intake and discharge channels. The sluiceway outlet works is located at the original Salmon Falls River bed.

Figure 1, located in Appendix B, shows the plan of the dam and its appurtenant structures. Photographs of each structure are shown in Appendix C.

c. Size Classification. Intermediate (hydraulic height - 15 feet high, storage - 27,700 acre-feet) based on storage ($\geq$ 1,000 to 50,000 acre-feet) as given in Recommended Guidelines for Safety Inspection of Dams.

d. Hazard Classification. The dam's potential for damage rates if as a significant hazard classification. A major breach could result in a maximum flood wave stage of 7.2 feet in Milton Mills, 5.3 miles downstream. The flood wave includes spillway flow at the top of dam. Between Great East Lake and Milton Mills there are few structures, except around Horn Pond 2,000 feet downstream, which would be affected by the anticipated rise in water level. Horn Pond would probably increase about 7.6 feet in level, thus flooding of homes surrounding the pond with the possible loss of a few lives, could be expected. See Section 5 of this report for details.

e. Ownership. This dam is owned by the New Hampshire Water Resources Board, Concord, New Hampshire 03301. Prior to 1963, the dam was owned by the Public Service Company of New Hampshire.

f. Operator. This dam is maintained and operated by the State of New Hampshire Water Resources Board, 37 Pleasant Street, Concord, New Hampshire 03301. Chairman of the Water Resources Board is Mr. George M. McGee, Sr.; Mr. Vernon Knowlton is Chief Engineer. Telephone No. (603)271-1110.

g. Purpose of Dam. The purpose of this dam is primarily to provide a recreational lake with some flood control benefits and water supply for power generation which are described in Section 4, Operational Procedures.

h. Design and Construction History. The dam at Great East Lake was originally constructed in about 1825 for the Great Falls Manufacturing Company to regulate the supply of water for power generation. No plans are available. About 1972 the dam was reconstructed by the New Hampshire Water Resources Board. No design or construction data were disclosed for this dam.

i. Normal Operational Procedure. Great East Lake Dam is used to control water levels on Great East Lake for recreational, flood control and power generating purposes. During the summer the outlet gate is closed and the lake level is controlled by the spillway. Following the recreational season, the level is dropped four to five feet to provide water for power generation downstream of Milton, N.H. and to provide flood control storage for winter and spring runoff.

1.3 Pertinent Data

a. Drainage Area. The area above Great East Lake Dam consists of 16 square miles of undeveloped area except for dwellings along the lake shore. Elevation through the basin varies from 900 to 570 feet MSL with sharp relief at the edges of the watershed and some flat areas in the central basin west of the lake.

The reservoir area of 1,800 acres takes up 18 percent of watershed area. It is heavily wooded with rolling terrain on the east and south sides. There are many cottages and docks located along the shore.

b. Discharge at Dam Site.

(1) The outlet works for Great East Lake Dam consist of one six (6) foot wide gate, set at invert 566.3 three feet above the streambed.

(2) No records of maximum discharge were disclosed.

(3) The spillway capacity with the water surface at the top of dam is approximately 350 cfs at elevation 578.5.

(4) The spillway capacity with the water surface at the test flood elevation of 580.0 is approximately 770 cfs.

(5) The total project discharge at the test flood elevation of 580.0 is approximately 900 cfs.

c. Elevation (feet above MSL)

(1) Streambed at centerline of dam - 563.1.

(2) Maximum tailwater - 571.4.

(3) Upstream portal invert diversion tunnel - none.

(4) Recreation Pool - 576.3

(5) Full flood control pool - 578.5.

(6) Spillway crest (permanent spillway) - 576.3.

(7) Design surcharge - unknown.

(8) Top Dam - 578.5.

(9) Test Flood Surcharge - 580.0.

d. Reservoir (miles)

(1) Length of Maximum Pool - 3.8.

(2) Length of Recreational Pool - 3.8.

(3) Length of Flood Control Pool - 3.8.

e. Storage (gross acre-feet)

(1) Recreation Pool - 19,600.

(2) Flood Control Pool - 27,700.

(3) Spillway Crest Pool - 23,760.

(4) Top of Dam - 27,700.

f. Reservoir Surface (acres) - vertical sides assumed.

(1) Recreation Pool - 1,800.

(2) Flood Control Pool - 1,800.

(3) Spillway Crest - 1,800.

(4) Test Flood Pool - 1,800.

(5) Top Dam - 1,800.

g. Dam

(1) Type - concrete gravity dam.

(2) Length - 67.8 feet, overall.

(3) Height - 15.4 feet (maximum).

(4) Top Width - varies.

(5) Side Slopes - US = vert.; DS = variable.

(6) Zoning - unknown.

(7) Impervious core - none.

(8) Cutoff - unknown.

(9) Grout Curtain - Unknown.

(10) Other - none.

h. Diversion and Regulating Tunnel

None.

i. Spillway

(1) Type - concrete broad crest weir.

(2) Length of Weir - total 41 feet.

(3) Crest Elevation - 576.3.

(4) Gates - stoplogs.

(5) U/S Channel - none.

(6) Downstream Channel. Through an 1,800 foot downstream reach of channel, the stream bed consists of a 13 foot bottom width channel with 10 foot high vertical banks all lined with stone masonary. About 700 feet downstream of the dam is a stone arch bridge for Canal Road.

j. Regulating Outlets. Water levels on Great East Lake can be controlled through a six (6) foot wide opening in the dam with a concrete invert set at elevation 566.3. The outlet is regulated by a gate which is mechanically operated from a gate house set on top of the dam. In addition, stoplogs can be placed immediately in front of the gate. The maximum discharge capacity of the gate with the water surface at the top of dam is approximately 650 cfs at elevation 578.5.

SECTION 2
ENGINEERING DATA

2.1 Design

The dam at Great East Lake was originally constructed in about 1825 for the Great Falls Manufacturing Company to regulate the supply of water for power generation. No plans or design data for the original construction are available. In 1972, the dam was reconstructed by the State of New Hampshire Water Resources Board. No design data were disclosed for this reconstruction. The only design data located were some hydraulic calculations for an emergency spillway design, dated 1971, and past inspection reports. The emergency spillway, however, does not appear to have been constructed.

2.2 Construction

No construction records were available for use in evaluating the dam.

2.3 Operation

No engineering operational data were disclosed.

2.4 Evaluation

a. Availability. Little engineering data were available for Great East Lake Dam. A search of the files of the New Hampshire Water Resources Board revealed only a limited amount of recorded information.

b. Adequacy. The lack of in-depth engineering data did not allow for a definitive review. Therefore, the adequacy of this dam could not be assessed from the standpoint of reviewing design and construction data, but is based primarily on visual inspection, past performance history and sound engineering judgment.

c. Validity. The field investigation indicated that the external features of Great East Lake Dam substantially agree with those sketches and photos made during past inspections.

SECTION 3
VISUAL INSPECTION

3.1 Findings

a. General. The field inspection of Great East Lake Dam was made on November 16, 1978. The inspection team consisted of personnel from Howard, Needles, Tammen & Bergendoff and Geotechnical Engineers, Inc. Inspection checklists, completed during the visual inspection are included in Appendix A. At the time of the inspection, the water level was approximately 2 feet - 4 inches below the permanent spillway elevation. No water was passing over the spillway. The upstream face of the dam could only be inspected above this water level.

b. Dam. Visual inspection indicates that the entire length of the dam between the abutments is concrete and that there is no embankment section between the ends of the concrete dam and the natural ground at the abutments.

It is not possible to determine from the visual inspection whether the concrete dam is founded on bedrock or soil.

At the time of the visual inspection there were no signs of seepage discharging from the foundation or abutments at the downstream side of the dam, which is consistent with the statement made in a New Hampshire Water Resources Board letter dated June 24, 1974 that "reconstruction (within the past couple of years) sealed off a considerable amount of leakage through the dam." (See Appendix B for referenced letter).

c. Appurtenant Structures. Visual inspection of the concrete spillway, outlet works structure and spillway/outlet works discharge channel did not reveal any evidence of stability problems. The concrete structures are in good sound condition. At the time of the visual inspection there were no signs of any concrete surface deteriorations.

The spillway structure consists of two 20-foot wide, flat slab sections, with one on either side of the outlet works structure. Each spillway slab has flash boards installed on the upstream face, as shown in Photos 2, and 3. The concrete spillway slabs were placed over a dry-masonry foundation and, in some areas, were probably founded on bedrock. The concrete surface of the spillway structure is in good condition.

The outlet works consists of a wooden, mechanically operated gate, gate house and concrete sluiceway through the dam. The sluiceway has a maximum effective opening of 6 feet wide by 12 feet high. The gate was not operated but visual inspection indicated that it was in good condition. The outlet works structure is located at the original Salmon Falls River bed. The concrete block gate house, located over the outlet works channel, is in good condition.

The service deck over the left spillway section and outlet works consists of a concrete deck, tube railing and concrete supports. The deck and the supports are in very good condition as shown in Photo 4.

d. Reservoir Area. The reservoir area is heavily wooded, rolling terrain. A more detailed description of the drainage area is included in Section 1.3 of this report. Many cottages and docks were observed along the shores. The area immediately behind the dam forms an approach channel to the spillway and outlet structures. The amount of siltation within the reservoir is unknown.

e. Downstream Channel. The discharge from the dam to the Canal Road, several hundred feet downstream, is about 10 feet deep and 10-15 feet wide. The sides of the channel are vertical, dry-masonry walls as shown in Photos 11 and 12. These dry-masonry walls have bulged locally and deviate slightly from a straight alignment, but no collapses have occurred.

There are some trees growing adjacent to the channel.

3.2 Evaluation

From the geotechnical and structural aspects of the inspection, Great East Lake Dam is considered to be in excellent condition.

There is no visual evidence of seepage through the foundation and abutments, which, according to the records, had been a problem prior to reconstruction of the dam in 1972.

The vertical, dry-masonry walls on the sides of the discharge channel, which have bulged locally and deviate slightly from a straight alignment, will continue to deteriorate with time. They should be insepcted periodically and be repaired, as needed, as part of the routine maintenance program.

SECTION 4
OPERATIONAL PROCEDURES

4.1 Procedure

The Great East Lake Dam is used primarily for the retention of Great East Lake which is used for recreational purposes. Secondary purposes of the dam and its resulting reservoir area is for control of winter and early spring runoff and water supply for power generation. The normal operational procedure for this dam is to remove the stoplogs in the sluiceway and open the sluiceway gate sometime in the month of October or November of each year thus lowering the reservoir level approximately 4 feet. The resultant available storage is used to control snowmelt and heavy runoff during the winter and spring months. In May of each year, the stoplogs are then reinserted into the sluiceway and the gate closed, thus returning the reservoir level to its summertime recreational level.

4.2 Maintenance of Dam

This dam is visited by one of the State of New Hampshire Water Resources Board's dam operators approximately once per week. During these visits water levels are recorded, grass is cut as necessary, painting is done as necessary and any major deficiencies that may be noted are reported to the Water Resources Board.

4.3 Maintenance of Operating Facilities

Maintenance on the outlet works facilities is done on an as needed basis.

4.4 Description of Warning Systems

There are no warning systems in effect at this facility.

4.5 Evaluation

The current operation and maintenance procedures for Great East Lake Dam are inadequate to insure that all [illegible] encountered can be remedied within a reasonable [illegible]. The owner should establish a written operation [illegible] procedure as well as establishing a warning [illegible] in event of flood flow conditions or imminent [illegible].

SECTION 5
HYDROLOGY AND HYDRAULIC ANALYSIS

5.1 Evaluation of Features

a. General. Great East Lake Dam is a composite structure consisting of concrete and stone having a total length of approximately 68 feet and a maximum structural height of about 15 feet. The appurtenant structures consist of two 20'-6" spillway sections, one either side of the outlet works and the outlet works, itself. The outlet works consist of a 6 foot wide sluiceway regulated by a mechanically operated gate. In addition, stoplogs can be placed immediately in front of the gate. The dam is located in the Salmon Falls River and creates an impoundment of water primarily used for recreational purposes. By lowering the reservoir level during the winter, the storage created behind the dam is also used to provide some control over snowmelt and stormwater runoff during the winter months. Great East Lake Dam is classified as being intermediate in size having a maximum storage of 27,700 acre-feet.

b. Design Data. No hydrologic or hydraulic design data were disclosed for Great East Lake Dam.

c. Experience Data. The maximum discharge at this dam site is unknown.

d. Visual Observations. No evidence of damage to any portion of the project from overtopping was visible at the time of the inspection.

e. Overtopping Potential. As no detailed design and operational information are available, hydrologic evaluation was performed using dam information gathered by field inspection, watershed size and an estimated test flood equal to 1/2 the Probable Maximum Flood (PMF) as determined by guide curves issued by the Corps of Engineers. Based on a drainage area of 16 square miles, it was estimated that the test flood inflow at Great East Lake Dam would be 5,200 cfs. Following the guidance for Estimating Effect of Surcharge Storage on Maximum Probable Discharge results in a test flood discharge of 900 cfs. As the maximum spillway capacity of the top of the dam is 350 cfs (approximately 39 percent of the test flood discharge flow), the test flood will cause the dam to be overtopped by approximately 1.5 feet.

f. Dam Failure Analysis. The impact of failure of the dam at maximum pool (top of dam) was assessed using the "Rule of Thumb" Guidance for Estimating Downstream Dam Failure Hydrographs issued by the Corps of Engineers. The analysis covered the reach extending from the dam to Milton Mills, 5.3 miles downstream. Failure of Great East Lake Dam would probably result in an increase of 7.7 feet in the pond level of Horn Pond located 2,000 to 7,000 feet downstream of the dam. An increase in depth of this magnitude would probably flood many of the cottages along the shore. Hazard to life resulting from the rise in water level should be minimal as it would rise at a rate of about one foot per hour. Between Horn Pond and the Town of Milton Mills 3.9 miles downstream, there are very few structures effected by any rise in stream stage. At Milton Mills, 5.3 miles downstream of the dam, the breach of dam outflow plus spillway discharge would probably result in a river stage of about 7.2 feet which would appear to cause no damage.

It should be noted, in regards to overtopping and dam failure, that because the dam is constructed entirely of concrete and stone, it is possible that the dam could withstand some overtopping without dam failure.

SECTION 6
STRUCTURAL STABILITY

6.1 Evaluation of Structural Stability

a. Visual Observations. The visual observation did not indicate any stability problems with respect to sliding and overturning of the concrete dam, or seepage through the foundation and abutments.

Minor bulging and misalignment of the vertical, dry-masonry walls on the sides of the discharge channel downstream of the dam indicate that the stability of those walls is deteriorating with time, and that they will need to be repaired from time to time as part of the routine maintenance program.

b. Design and Construction Data. No design or construction data are available. Therefore, the evaluation of the structural stability must be based primarily on the information from the visual inspection.

c. Operating Records. The records that were reviewed indicate that significant seepage had occurred through the foundation and/or abutments of the dam, and that this seepage had stopped after the reconstruction of the dam in 1972. No other operating records pertinent to the structural stability of the dam were available.

d. Post-construction Changes. The records that were reviewed indicate that the dam was refaced and the spillway modified in 1972.

e. Seismic Stability. The dam is located in Seismic Zone 2, and in accordance with recommended Phase I guidelines does not warrant seismic analysis.

SECTION 7
ASSESSMENT, RECOMMENDATIONS AND REMEDIAL MEASURES

7.1 Dam Assessment

a. Condition. From the geotechnical and structural standpoints, this dam is considered to be in excellent condition. However, as hydraulic analysis reveals that the dam cannot pass the required test flood, the overall condition of the dam is considered good. The inspection revealed only minor bulging and misalignment of the vertical, dry-masonry walls on the sides of the discharge channel.

b. Adequacy of Information. The lack of in-depth engineering data did not allow for a definitive review. Therefore, the adequacy of this dam could not be assessed from the standpoint of reviewing design and construction data, but is based primarily on visual inspection, past performance history and sound engineering judgment.

c. Urgency. This dam is in good condition. The recommendations and remedial measures described in Sections 7.2 and 7.3 should be accomplished within two years after receipt of this Phase I Inspection Report by the owner.

d. Need for Additional Investigation. The findings of this inspection indicate that there is no need for additional investigation.

7.2 Recommendations

It is recommended that the owner engage a qualified engineer to evaluate further the potential for overtopping and the inadequacy of the spillway.

7.3 Remedial Measures

(a) Inspect the condition of the vertical, dry-masonry walls on the sides of the discharge channel from the dam to Canal Road at least once a year and make repairs when needed.

(b) Develop a written operational procedure and warning system to follow in the event of flood flow conditions or imminent dam failure. The warning system should discuss the operation of the gates during flood flow conditions and the steps to be taken by local officials for altering downstream residents in case of emergency.

(c) Institute a technical inspection program on a biennial basis.

7.4 Alternatives

There are no practical alternatives to the recommendations in Section 7.2 and 7.3 except that on an interim basis the owner may consider operating the reservoir at a lower level throughout the year so as to provide more storage for extreme flood events.

APPENDIX A

VISUAL CHECKLIST WITH COMMENTS

VISUAL INSPECTION CHECK LIST
PARTY ORGANIZATION

PROJECT Great East Lake Dam, NH

DATE Nov. 16, 1978

TIME 3:00 P.M.

WEATHER Sunny, Cool

W.S. ELEV. 574.1 U.S. 564± DN.S

PARTY:

1. Gordon Slaney
2. Stan Mazur
3. Ronald Hirschfeld
4.
5.
6.
7.
8.
9.
10.

PROJECT FEATURE	INSPECTED BY	REMARKS
1. Dam	Ronald Hirschfeld	
2. Spillway/Outlet Works	Stan Mazur	
3.	Gordon Slaney	
4.		
5.		
6.		
7.		
8.		
9.		
10.		

PERIODIC INSPECTION CHECK LIST

PROJECT Great East Lake Dam, NH DATE Nov. 16, 1978

PROJECT FEATURE Dam NAME R. Hirschfeld

DISCIPLINE Geotechnical Engineer NAME

AREA EVALUATED	CONDITION
DAM EMBANKMENT	
Crest Elevation	No embankment.
Current Pool Elevation	
Maximum Impoundment to Date	
Surface Cracks	
Pavement Condition	
Movement or Settlement of Crest	
Lateral Movement	
Vertical Alignment	
Horizontal Alignment	
Condition at Abutment and at Concrete Structures	
Indications of Movement of Structural Items on Slopes	
Trespassing on Slopes	
Sloughing or Erosion of Slopes or Abutments	
Rock Slope Protection - Riprap Failures	
Unusual Movement or Cracking at or near Toes	
Unusual Embankment or Downstream Seepage	
Piping or Boils	
Foundation Drainage Features	
Toe Drains	
Instrumentation System	

PERIODIC INSPECTION CHECK LIST

PROJECT Great East Lake Dam, NH — DATE Nov. 16, 1978

PROJECT FEATURE Intake Channel/Structure — NAME R. Hirschfeld

DISCIPLINE Structura/Hydraulic/Geotechnical Engineers — NAME S. Mazur, G. Slaney

AREA EVALUATED	CONDITION
OUTLET WORKS - INTAKE CHANNEL AND INTAKE STRUCTURE	
a. Approach Channel	
Slope Conditions	Good.
Bottom Conditions	Good.
Rock Slides or Falls	None.
Log Boom	
Debris	
Condition of Concrete Lining	
Drains or Weep Holes	None apparent.
b. Intake Structure	
Condition of Concrete	Good.
Stop Logs and Slots	Good.

PERIODIC INSPECTION CHECK LIST

PROJECT Great East Lake Dam, NH DATE Nov. 16, 1978

PROJECT FEATURE Outlet Works/Controls NAME S. Mazur

DISCIPLINE Structural Engineer NAME

AREA EVALUATED	CONDITION
OUTLET WORKS - CONTROL TOWER	Concrete-sluiceway structure with mechanically controlled wooden gate.
a. Concrete and Structural	
General Condition	Good.
Condition of Joints	Good.
Spalling	None.
Visible Reinforcing	None.
Rusting or Staining of Concrete	None observed.
Any Seepage or Efflorescence	None observed.
Joint Alignment	Good.
Unusual Seepage or Leaks in Gate Chamber	None observed.
Cracks	
Rusting or Corrosion of Steel	
b. Mechanical and Electrical	
Air Vents	Mechanical control for wooden gate. Good condition.
Float Wells	
Crane Hoist	
Elevator	
Hydraulic System	
Service Gates	
Emergency Gates	
Lightning Protection System	
Emergency Power System	
Wiring and Lighting System	

PERIODIC INSPECTION CHECK LIST

PROJECT Great East Lake Dam, NH DATE Nov. 16, 1978

PROJECT FEATURE Transitions & Conduit NAME

DISCIPLINE NAME

AREA EVALUATED	CONDITION
OUTLET WORKS - TRANSITION AND CONDUIT	None.
General Condition of Concrete	
Rust or Staining on Concrete	
Spalling	
Erosion or Cavitation	
Cracking	
Alignment of Monoliths	
Alignment of Joints	
Numbering of Monoliths	

PERIODIC INSPECTION CHECK LIST

PROJECT Great East Lake Dam, NH — DATE Nov. 16, 1978

PROJECT FEATURE Outlet Structure/Channel — NAME R. Hirschfeld

DISCIPLINE Structural/Hydraulic/Geotechnical Engineers — NAME S. Mazur, G. Slaney

AREA EVALUATED	CONDITION
OUTLET WORKS -- OUTLET STRUCTURE AND OUTLET CHANNEL	Sluiceway which is only way of outletting water other than the spillway consists of mechanically controlled wooden gate. Gate and concrete in good condition.
General Condition of Concrete	Good.
Rust or Staining	None observed.
Spalling	None.
Erosion or Cavitation	None.
Visible Reinforcing	None.
Any Seepage or Efflorescence	None observed.
Condition at Joints	
Drain Holes	None apparent.
Channel	
Loose Rock or Trees Overhanging Channel	Some trees overhanging canal.
Condition of Discharge Channel	Bulges in dry masonry canal wall, but otherwise in good condition.

PERIODIC INSPECTION CHECK LIST

PROJECT Great East Lake Dam, NH DATE Nov. 16, 1978

PROJECT FEATURE Spillway/Channel NAME R. Hirschfeld

DISCIPLINE Structural/Hydraulic/Geotechnical Engineers NAME S. Mazur, G. Slaney

AREA EVALUATED	CONDITION
OUTLET WORKS - SPILLWAY WEIR, APPROACH AND DISCHARGE CHANNELS	
a. Approach Channel	
General Condition	Good.
Loose Rock Overhanding Channel	None.
Trees Overhanging Channel	None.
Floor of Approach Channel	Boulders, sand and gravel.
b. Weir and Training Walls	
General Condition of Concrete	Good.
Rust or Staining	None observed.
Spalling	None.
Any Visible Reinforcing	None.
Any Seepage or Efflorescence	None observed.
Drain Holes	None apparent.
c. Discharge Channel	
General Channel	Good.
Loose Rock Overhanging Channel	Walls of canal are dry masonry.
Trees Overhanging Channel	Some trees.
Floor of Channel	Boulders.
Other Obstructions	None.

PERIODIC INSPECTION CHECK LIST

PROJECT Great East Lake Dam, NH — DATE Nov. 16, 1978

PROJECT FEATURE Service Deck — NAME S. Mazur

DISCIPLINE Structural Engineer — NAME

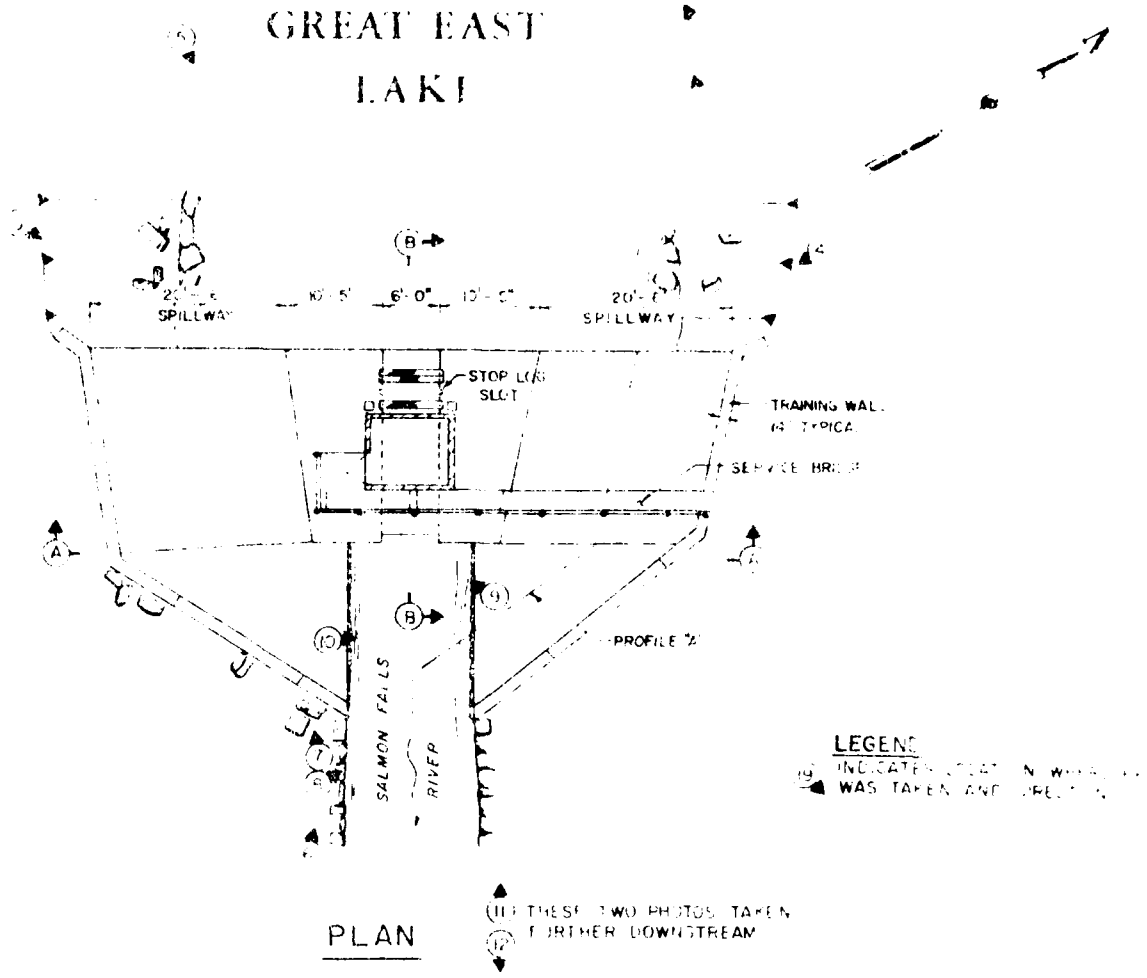
AREA EVALUATED	CONDITION
OUTLET WORKS - SERVICE BRIDGE	
a. Super Structure	Service-deck over spillway consist of a concrete deck and railing.
Bearings	
Anchor Bolts	
Bridge Seat	
Longitudinal Members	
Under Side of Deck	
Secondary Bracing	
Deck	Good.
Drainage System	None.
Railings	Good.
Expansion Joints	None.
Paint	
b. Abutment & Piers	Service-deck is supported on spillway walls and short concrete piers.
General Condition of Concrete	
Alignment of Abutment	
Approach to Bridge	
Condition of Seat & Backwall	

APPENDIX B

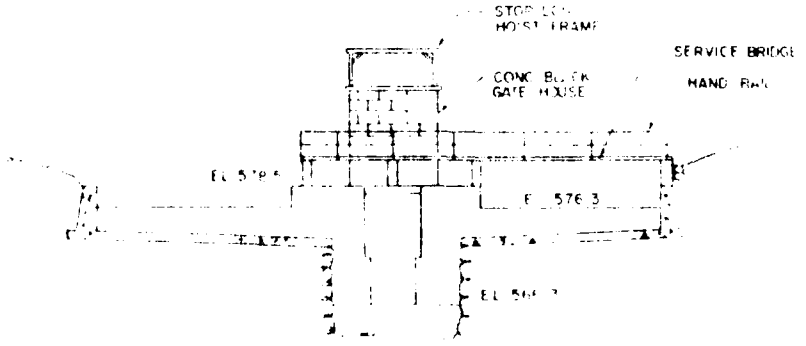
1. LIST OF DESIGN, CONSTRUCTION AND MAINTENANCE RECORDS
2. PLANS AND DETAILS
3. PAST INSPECTION REPORTS

AVAILABLE ENGINEERING DATA

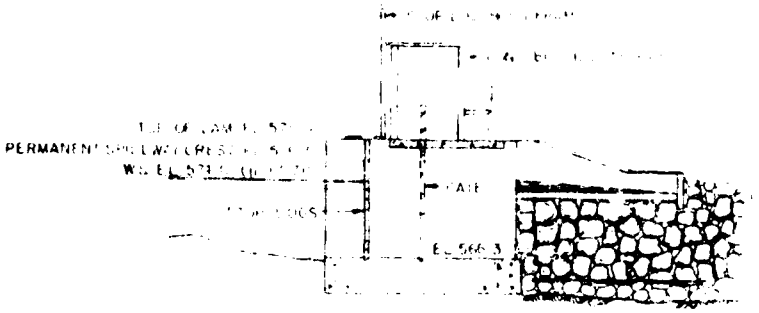
No engineering design data, plans or construction data were found to be available for Great East Lake Dam.



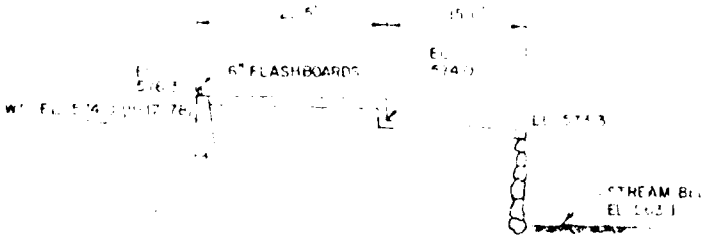
PLAN



SECTION A-A



SECTION B-B



PROFILE "A"

NOTES

1. THE INFORMATION SHOWN ON THIS DRAWING IS BASED ON APPROXIMATE MEASUREMENTS AND VISUAL OBSERVATIONS MADE DURING A FIELD INSPECTION. DIMENSIONS OR MATERIALS INDICATED ON THESE DRAWINGS WHICH WERE BELOW GRADE OR WATER DURING THE TIME OF INSPECTION WERE NOT VERIFIED.
2. THE ELEVATIONS SHOWN ARE BASED ON AN ELEVATION OF 574.0 SHOWN IN USGS BENCHMARK SHEET. ASSUMED TO BE POOL ELEVATION AT TIME OF INSPECTION (11 MARCH

NATIONAL PROGRAM OF INSPECTION OF NON-FEDERAL DAMS

GREAT EAST LAKE

SALMON RIVER — PASSAIC COUNTY, NEW JERSEY

PAST INSPECTION REPORTS

M E M O R A N D U M

October 1, 1970

TO: Vernon A. Knowlton, Water Resources Engineer
(Copy to Mr. Ecklof, Water Supply & Pollution Control Commission)

RE: Proposed Fill on Land Adjoining Great East Lake in Wakefield

The following measurements were taken and information compiled to establish an elevation for filling in areas of land around the lake for future projects such as sewage systems, buildings, beaches, etc.

On September 30, 1970, I went to the dam at the outlet of the lake and observed that there are steel pins in the concrete on the upstream side of the dam, one on the New Hampshire side and one on the Maine side and that they are both the same elevation as the spillway.

The elevation that we have for these pins is elevation 100.0 which was given by the Public Service Company of New Hampshire and is used in all past and present lake level recording and is documented in the court decree of 1940 which set the limits for drawdown. In the court decree under paragraph #4, it notes for flowage rights as the height of the water "at which it stands at any season when the flow of the stream is running over the top of the respondent's said dam, the top of said spillway being at an elevation known as elevation 100.0".

Investigation into all recorded lake level readings on hand show relatively few instances of water in the lake exceeding elevation 100.0 and in the instances of the higher readings, elevation 100.25 would appear to be average. The highest recordings on hand are 100.5 on 4/19/38 and 100.8 on 5/23/67 and both were of short duration.

It is my conclusion from the information available that any areas above elevation 100.0 adjoining this lake can be filled without encroaching upon the flowage rights of this lake.

It should be noted here that elevation 574 on Great East Lake as shown on the U.S.G.S. map is not recorded as having been established as "full lake" or equal to elevation 100.0 as we know it.

Peter J. Verbeg
Water Resources Engineer

State of New Hampshire

WATER RESOURCES BOARD

37 Pleasant St
Concord 03301

June 24, 1974

Mr. William Haubrich, Vice President
Great East Lake Association
Ten Sunset Avenue
Concord, NH 03301

Dear Mr. Haubrich:

In regard to your letter of May 8, 1974, and our conversation of this date relating to the Water Resources Board's operation of Great East Lake, I am supplying the following data which may be of interest to members of the Great East Lake Association for discussion at your annual meeting.

The Great East Lake dam was originally built by Great Falls Manufacturing Company about 150 years ago to supplement several other storage reservoirs on the Salmon Falls River to furnish power to operate downstream mills in Rochester, Somersworth, etc. These rights were sold to Public Service Company of New Hampshire 45 years ago for water conservation for hydroelectric generation along the Salmon Falls River. With taxes on both storage reservoirs and dams and labor for hydroelectric generation increasing, Public Service Company of New Hampshire in 1963 sold for one dollar seven dams and reservoirs in New Hampshire and Maine to the State of New Hampshire for operation by the Water Resources Board.

Since 1963 the N. H. Water Resources Board has maintained and operated the dam at the outlet of Great East Lake in general for the recreational interests of this lake. Following the recreational season the level of this lake is dropped four to five feet during the fall months to provide water for generation downstream of Milton, N. H., and to provide flood control storage for future runoff conditions. This operation and the operation of six other reservoirs on the Salmon Falls River during the recreational season provide a minimum flow for process water, and during the remainder of the year a supply of water for power generating plants downstream of the Milton dam. The flow of water in the river is gauged by the use of a Telemark device located on the Milton Three Ponds Dam. These measurements are monitored daily, and gates and stop logs on the dams upstream are operated to meet the downstream requirements.

Throughout the year, dam operators average a weekly visit to Great East Lake, and during periods of high flow as many as four trips may be made.

Over the past ten years, the Water Resources Board in conjunction with the State of Maine and the different interests in the watershed, has transferred all of its land at the outlet of Great East Lake to the State of Maine, which maintains this property in public use for boat launching and other assorted uses.

Within the past couple of years, the Board completely rebuilt the dam at the outlet, thereby providing a larger spillway crest which will result in a more stable water level; the crest being maintained by flashboards which under flood conditions can pass a substantial flow automatically, thereby relieving the Board of constant operation. Last year the Board installed locking devices on the stop logs on this dam to prevent unauthorized use of the structure. This reconstruction also sealed off a considerable amount of leakage through the dam which will result in further stabilizing the lake level.

Great East Lake has a water surface of approximately 1800 acres, and a drainage area of approximately 17 square miles which provides a lake rise of 5.4 inches of water on the lake for every inch of runoff on the drainage basin. During the fall and winter months the Water Resources Board lowers the lake to an amount which will store the spring runoff (possibly eight to ten inches), which is capable of raising the level of Great East Lake four or more feet in an average year. This storage provides relief from high water conditions to the area downstream of Great East Lake, as well as providing an economical use of the water released from this storage in the fall. In these past few years, the Board in cooperation with the lake property owners, the Fish and Game Departments and water users downstream have adjusted its flow operation so as to lower the level of Great East Lake to benefit the fish spawning. Due to the vast amount of water stored on this lake, it has been necessary to begin the fall drawdown right after Labor Day in order to accomplish the drawdown before October 15 without wasting the beneficial use of the water being discharged. In the past year of our operation, it appears that our operation has met the requirements of the association and will continue to do so in the future unless it is the interest of the different concerns to revise this operation.

Very truly yours,

Vernon A. Knowlton
Chief Engineer

vak:js
enclosure: Rules and regulations for dredging and filling in the waters of the State.

APPENDIX C

PHOTOGRAPHS

FOR LOCATION OF PHOTOS, SEE FIGURE 1
LOCATED IN APPENDIX B

PHOTO NO. 1 - View of approach channel and reservoir.

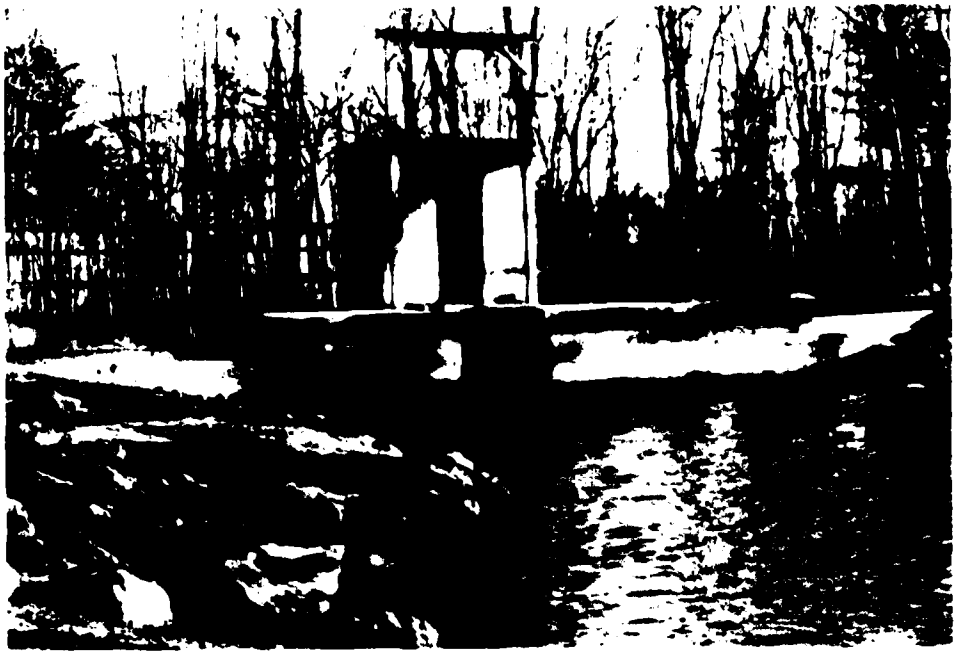


PHOTO NO. 2 - View of approach channel and upstream side of dam.

PHOTO NO. 3 - View of dam from right abutment (upstream side).

PHOTO NO. 4 - View of dam from left abutment (upstream side).

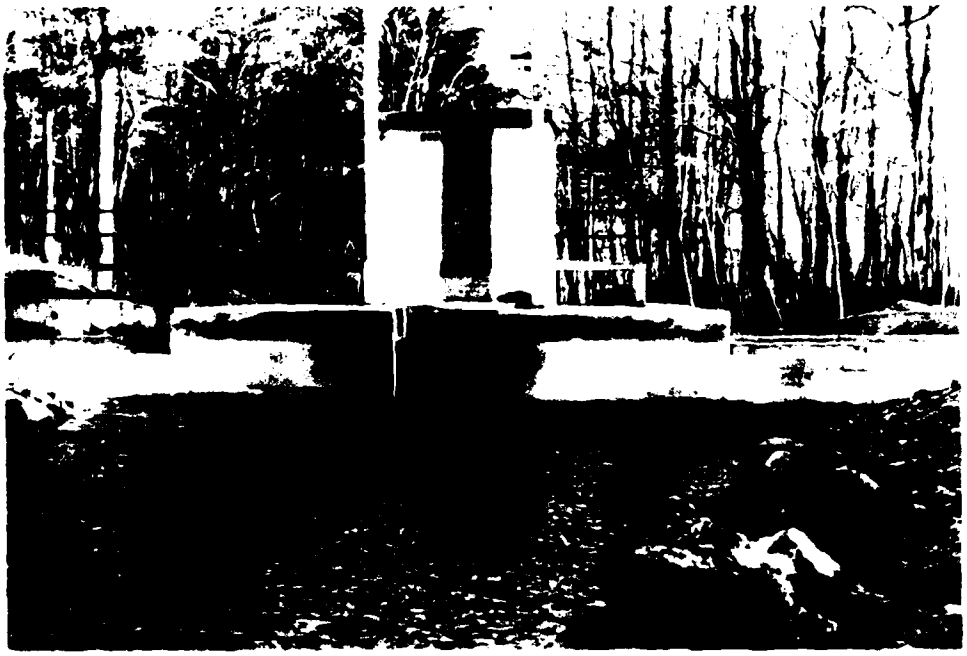


PHOTO NO. 5 - View of upstream side of the dam.

PHOTO NO. 6 - View of downstream side of dam (outlet works structure).

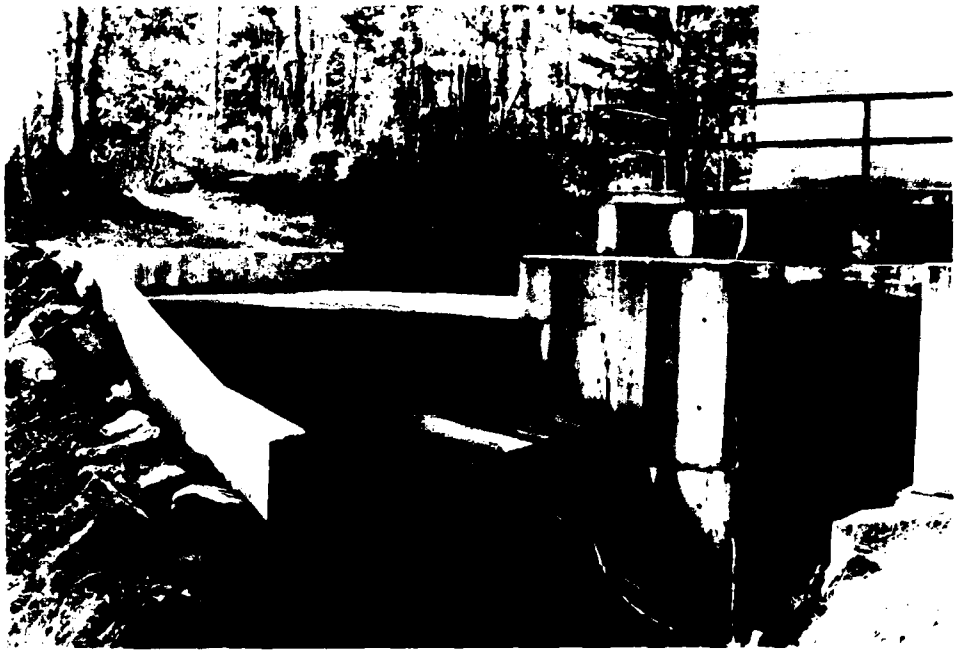


PHOTO NO. 7 - View of right section of spillway.

PHOTO NO. 8 - View of left section of spillway.

PHOTO NO. 9 - Detail of right spillway section.

PHOTO NO. 10 - Detail of left spillway section.

PHOTO NO. 11 - View of discharge channel, looking upstream.

PHOTO NO. 12 - View of discharge channel, looking downstream.

APPENDIX D

HYDROLOGIC AND HYDRAULIC COMPUTATIONS

HNTB HOWARD NEEDLES TAMMEN & BERGENDOFF	Made by RY	Date 11/30/78	Job No 5622-11-
	Checked by [illegible]	Date [illegible]	Sheet No 1

For GREAT EAST LAKE DAM

HYDRAULICS & HYDROLOGY

GREAT EAST LAKE DAM Located in Wakefield N.H on the Maine-New Hampshire Boundry across the Salmon Falls River tributary to the Atlantic Ocean.

Classification size : Intermediate
Hazard : Significant

Basic Data D.A. = 16 sq.mi. (HNTB checked)
Upstream Basin : use flat-coastal as a 40% of basin is either lake, swamp, or flat area
Reservoir : Normal Pool 574.0 usgs elev.
storage 19,600 acre-ft
Max. Pool 578.5 usgs elev.
27,700 acre-ft.
Surface Area : 1800 acres

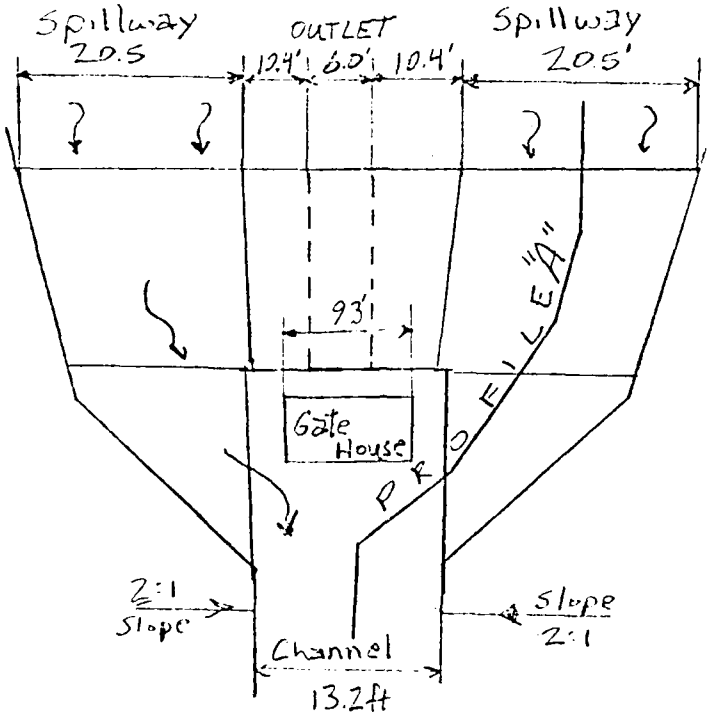
Dam : Concrete
15.4' max. height.
67.8' Long

Spillway : 2 sections of broad crest weir
20.5' long each
576.3 crest elev.

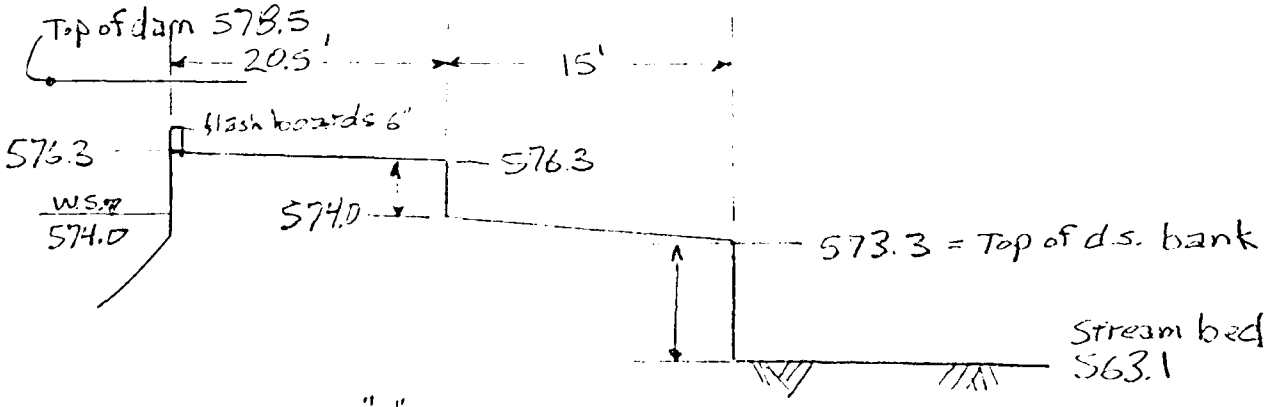
Outlet: one 6ft. wide gate
invert 566.3

HOWARD NEEDLES TAMMEN & BERGENDOFF	Made by RY	Date 11/28/78	Job No 5628-11-2
	Checked by	Date	Sheet No 2

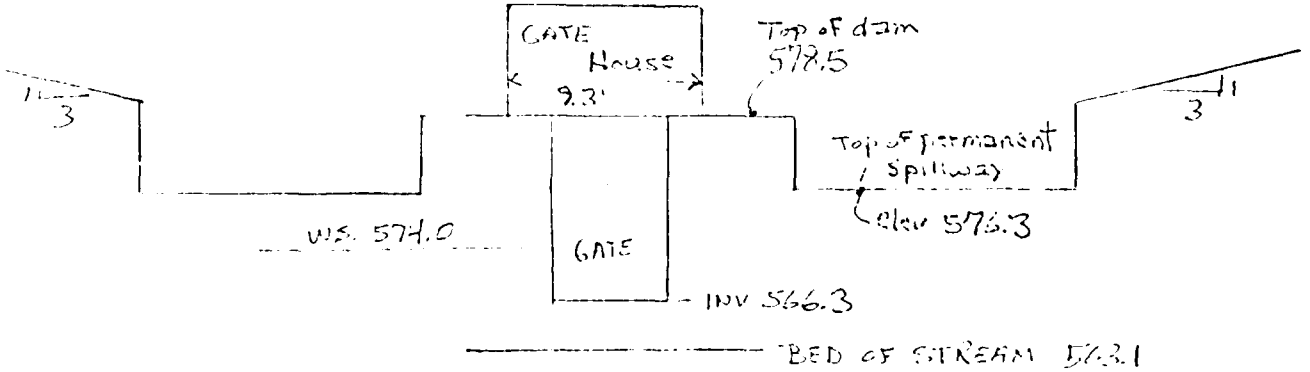
For GREAT EAST Lake



Plan no scale



"A" PROFILE no scale



HOWARD NEEDLES TAMMEN & BERGENDOFF	Made by RY	Date 11/30/78	Job No 5623-11
	Checked by [illegible]	Date [illegible]	Sheet No 3

For GREAT EAST LAKE

Step 1 Calculation of Spillway Design Flood (SDF)

Classification Size: Intermediate
Hazard: Significant

Hydrologic Evaluation Guideline Recommends

½ PMF to PMF

As size classification in the mid range of values for storage and low range for height use ½ PMF as much of basin is lakes or swamps and flat land adjacent to reservoir.

PMF = 650 cfs/sqmi × 16 sqmi = 10400 cfs

Spillway design flood = 5200 cfs.

Step 2 Calculation of Surcharge by PMF (½)

Consider: Gate in closed position
Stop logs in place
Minimal flow around sides of dam

Spillway: Broad crested weir

$$Q_s = C L H^{3/2}$$

where $C = 2.65$

$L = 2 \times (20.5) = 41$ ft

Crest elev. 576.3

$$Q_s = 108.6\, H^{3/2}$$

Flow over center portion of dam
crest elev. 578.5
Broad crest weir
$Q = C L H^{3/2}$
$C = 2.65$
$L = 10.4 + 6 + 10.4 = 28.8$ ft
minus width of gate house 9.3'
$L = 19.5$ ft

$Q = 51.7 H^{3/2}$

Stage - Discharge
see fig. 1

Elev W.S.	Spillway H	Spillway Q	Dam H	Dam Q	Q_{Total}
578.5	2.2 ft	350 cfs	0	—	350
580	3.7	770	1.5 ft	100 cfs	870 cfs
582	5.7	1480	3.5	340	1820
584	7.7	2320	5.5	670	2990
586	9.7	3280	7.5	1060	4340
588	11.7	4350	9.5	1510	5860

Maximum TW @ 5,200 cfs = elev. 582.5

Step 3 Effect of Surcharge on PMF

Q_{PI} = 5200 cfs = SPF = 1/2 PMF

Surcharge, 10.8 ft

$$Stor_1 = \frac{10.8 \text{ ft} \times 12 \text{ in/ft} \times 1800 \text{ acres}}{165 \text{ sq mi} \times 640 \text{ acres/mi}^2} = 22.8 \text{ inches}$$

Step 3 Effect of Surcharge on ½ PMF

Use Surcharge Storage routing alternative – graphical solution (iteration method does not close)

$Q_{P_1} = 5200$ cfs

Runoff for ½ PMF = 9.5 in

$$Q_{P_2} = Q_{P_1} \times \left(1 - \frac{Stor}{9.5}\right)$$

$$Stor = \frac{Surcharge \times 12\ in/ft \times 1800\ acres}{16\ sq\ mi \times 640\ acre/mi^2}$$

Elevation	Surcharge	Stor	Q_{P_2}
578.3	2 ft	4.22 in	2890 cfs
579.3	3	6.32 in	1740 cfs
580.3	4	8.44 in	580 cfs

See fig 1 for plot and final outflow.

From Fig 1 Outflow = 900 cfs

Stage 3.7 ft above spillway Elev 580.0
1.5 ft above Top of Dam

HOWARD NEEDLES TAMMEN & BERGENDOFF	Made by RY	Date 1/15/79	Job No 5628-11-;
	Checked by VTO	Date 1/[illegible]/79	Sheet No 6

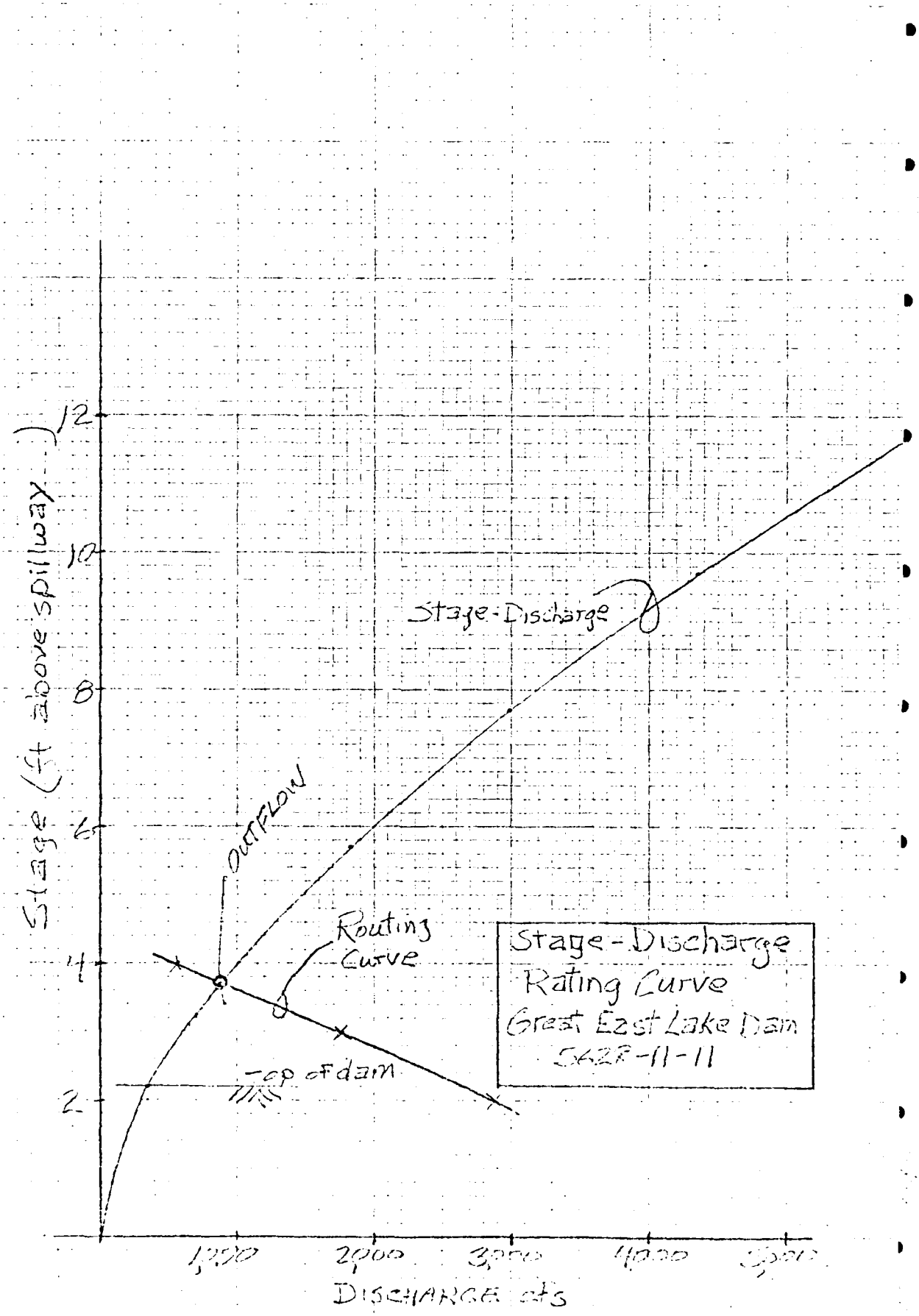
For GREAT EAST LAKE

CONCLUSIONS

1. Reservoir Storage will reduce the SDF at the outlet from 5200cfs to 900 cfs or by 83%

2. The spillway and storage capacity can safely pass 39% of the test flood.

3. At the test discharge of 900 cfs the dam crest will be overtopped by 1.5 ft.


Stage (ft above spillway)
12
10
8
6
4
2
Stage-Discharge
OUTFLOW
Routing Curve
Top of dam
Stage-Discharge Rating Curve
Great East Lake Dam
SCS-11-11
1,000
2,000
3,000
4,000
5,000
DISCHARGE cfs

ESTIMATE of Downstream Damage

Step 1 Reservoir Storage

Surface Area 1800 acres

Elev.		depth ft	Increment Storage acre-ft	Total Storage acre-ft
563.1		0	0	0
566.3	gate invert	3.2	5760	5760
574.0	Normal water	10.9	13860	19620
576.3	Spillway crest	13.2	4140	23760
578.5	Top of dam	15.4	3960	27720

Step 2 Peak Failure Outflow

$$Q_{P_1} = \frac{8}{27}\sqrt{g}\, W_b\, Y_0^{3/2}$$

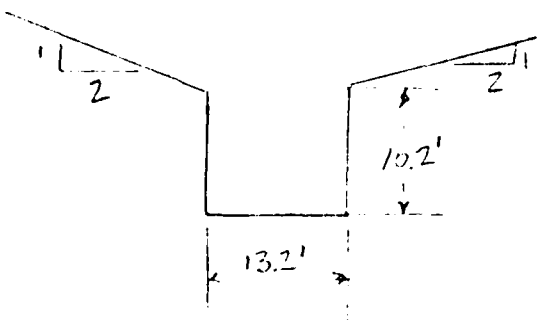
W_b = 40% of dam length at mid stream = 40% (67.8)

Y_0 = height stream bed to max. pool = 15.4

$$Q_{P_1} = \frac{8}{27}\sqrt{g}\,(40)(67.8)(15.4)^{3/2} = 2753 \text{ cfs}$$

Use Q_{P_1} = 2750 cfs.

Step 3 Downstream Rating Curve



Reach Characteristics

L = 1800 ft

S = 0.011 ft/ft

n = .04

Stage	Discharge
5 ft.	515 cfs
10.2	1330
14	2190
16	3090

Step 4 Downstream Damage Routing

$Q_{P_1} = 2750$ cfs Stage = 15.25 ft

$Area_1 = 252$ ac

$$V_1 = \frac{252 \times 1800}{43560} = 10.4 \text{ acre-ft} < \frac{27700}{2}$$

Reach length O.K.

$$Q_{P_{2\,TRIAL}} = Q_{P_1}\left(1 - \frac{V_1}{S}\right) = 2750\left(1 - \frac{10.4}{27{,}700}\right) = 2750 \text{ cfs}$$

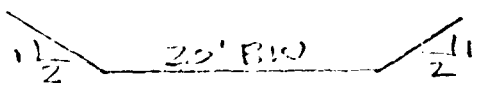
No channel Storage

Reach Outflow 2750 cfs.
Stage 15.25 ft.

Step 5 Reach 2 Horn Pond

Use surcharge storage routing method to Determine levels in Horn Pond Normal elev 554

Assume OUTLET IS NATURAL Channel $S = 0.004$ ft/ft $n = .04$



Stage	Discharge
3 ft	322 cfs
7	1114
10	3170

Peak INFLOW = 2750 cfs = Q_{P_1}

Surcharge$_1$ = 2.3 ft

$$Stor_1 = \frac{2.3\text{ ft} \times 12\text{ in/ft} \times 200\text{ acres}}{16\text{ ac-ft/in} \times 640\text{ ac/mi}^2} = 2.18\text{ inches}$$

If PMF = 650 ccm (storage - in Great East Lake)

then = 650 ccm (16 ac-ft/in) = 10,400 cfs

and $\frac{2750\text{ cfs}}{10400\text{ cfs}} \times 17\text{ inches} = 5.02\text{ inches}$

to use in $Q_{P_2} = Q_{P_1}\left(1 - \frac{Stor_1}{PMFR}\right)$

$$Q_{P_2} = Q_{P_1}\left(1 - \frac{Stor_1}{5.02}\right) = 2750\left(1 - \frac{2.18}{5.02}\right) = 1556\text{ cfs}$$

Surcharge$_2$ = 7.2 ft

$$Stor_2 = \frac{7.2 \times 12 \times 200}{16 \times 640} = 1.69\text{ in}$$

$$Stor_{AVE_1} = \frac{Stor_1 + Stor_2}{2} = \frac{2.18 + 1.69}{2} = 1.93\text{ in}$$

$$Q_{P_3} = Q_{P_1}\left(1 - \frac{Stor_{AVE_1}}{5.02}\right) = 2750\left(1 - \frac{1.98}{5.02}\right) = 1665\text{ cfs}$$

Surcharge$_3$ = 7.5 ft

$$Stor_3 = \frac{7.5 \times 12 \times 200}{16 \times 640} = 1.76\text{ inch}$$

$$Stor_{AVE_2} = \frac{Stor_3 + Stor_{AVE_1}}{2} = \frac{1.76 + 1.93}{2} = 1.84\text{ inches}$$

$$Q_{P_4} = Q_{P_1}\left(1 - \frac{STOR_{AVE2}}{5.0Z}\right) = 2750\left(1 - \frac{1.84}{5.0Z}\right) = 1742 \text{ cfs}$$

Surcharge = 7.6 ft

$$STOR_4 = \frac{7.6 \times 12 \times 200}{16 \times 440} = 1.78 \text{ inches}$$

$$STOR_{AVE3} = \frac{STOR_4 + STOR_{AVE3}}{2} = \frac{1.78 + 1.84}{2} = 1.81 \text{ inches}$$

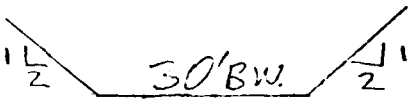
STOR Values close to within 2% use Q_{P_5} as outflow

$$Q_{P_5} = 2750\left(1 - \frac{1.81}{5.0Z}\right) = 1760 \text{ cfs}$$

Stage = 7.65 ft

Step 6 Continue channel reach routing

Reach 3



Reach Characteristics

L = 23,000 ft
S = .0037
n = .04

Stage	Discharge
3 ft	1150 cfs
5	1130
7	2010

$Q_{P_1} = 1760$ cfs stage$_1$ = 6.45 ft

Area$_1$ = 277 a'

$$V_1 = \frac{277 \times 23{,}000}{43560} = 146 \text{ acre-ft} < \frac{27{,}700}{2}$$

$$Q_{P_2 TRIAL} = Q_{P_1}\left(1 - \frac{V_1}{S}\right) = 1760\left(1 - \frac{146}{27700}\right) = 1750 \text{ cfs}$$

Stage$_2$ = 6.40 ft Area$_2$ = 274 a'

$$V_2 = \frac{274 \times 23{,}000}{43{,}560} = 145 \text{ acre-ft}$$

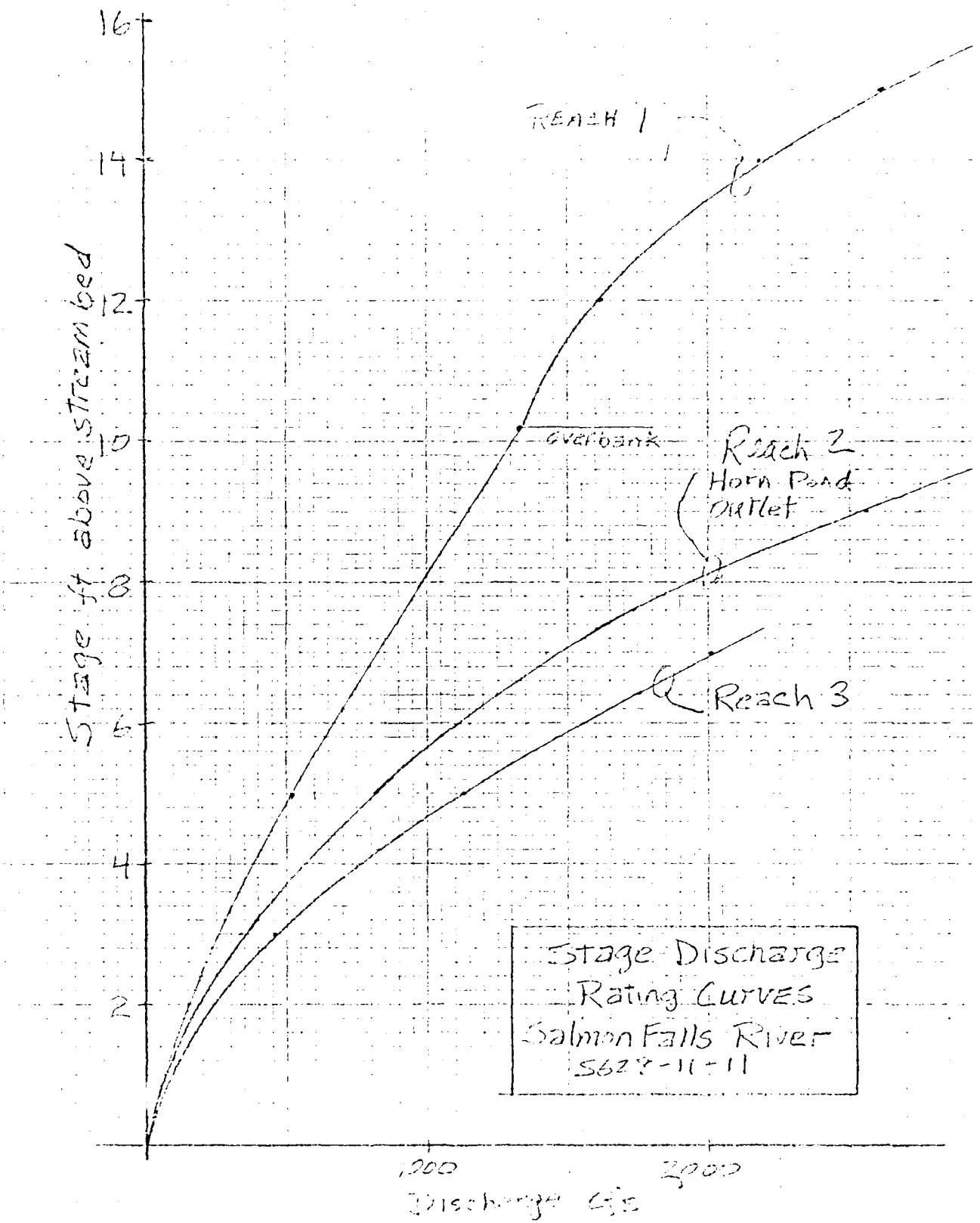
$$V_{AVE} = \frac{V_1 + V_2}{2} = \frac{146 + 145}{2} = 145.5 \text{ acre-ft}$$

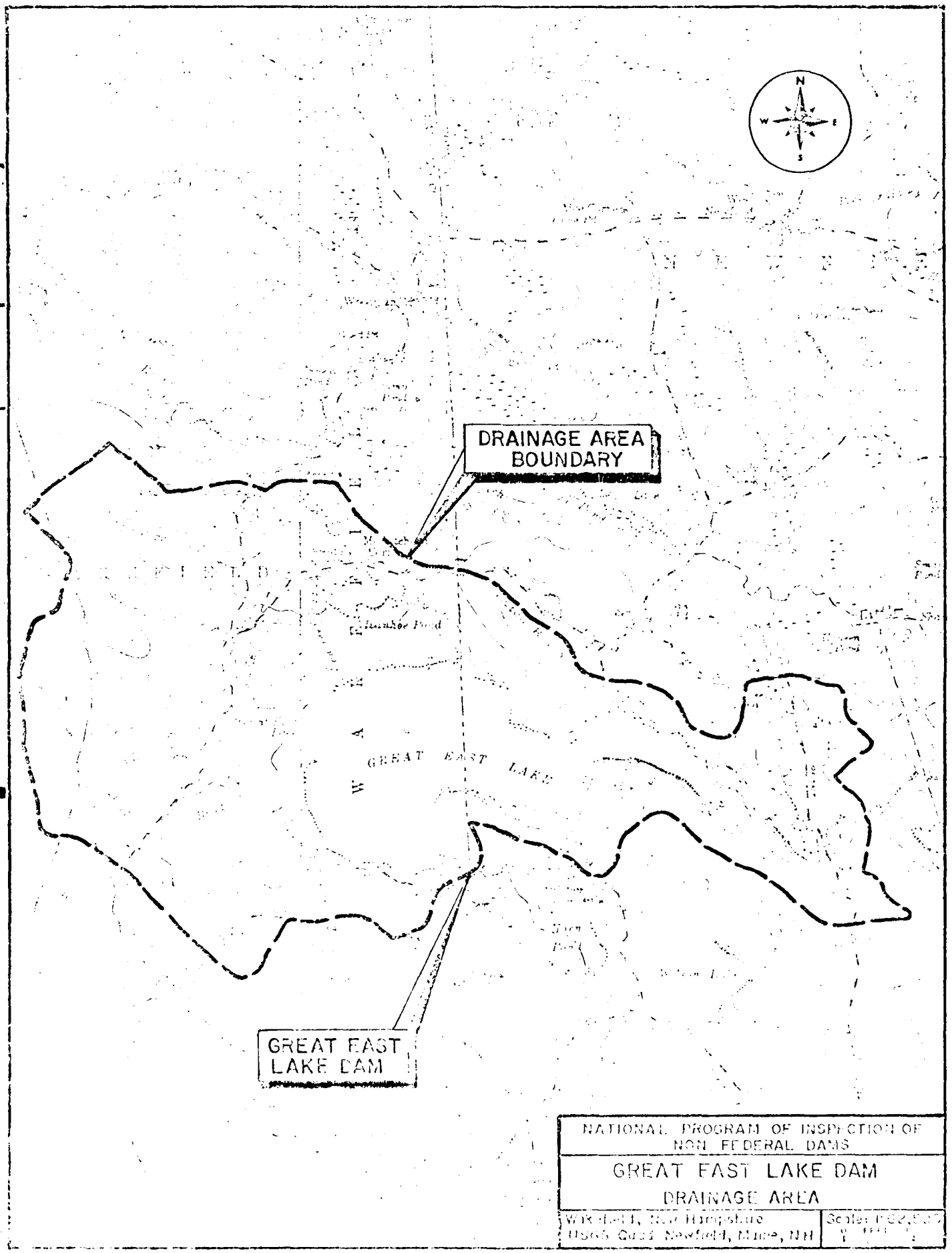
$$Q_{P_2} = Q_{P_1}\left(1 - \frac{V_{AVE}}{S}\right) = 1760\left(1 - \frac{145.5}{27{,}700}\right) = 1750 \text{ cfs}$$

Stage = 6.40 ft

SUMMARY

Stage	Discharge
At Dam	15.25 ft
1800 ft downstream of dam at head of Horn Pond	15.25 ft
At outlet of Horn Pond	7.65 ft
At Milton Falls Milton Falls Rd 32,000 ft d/s of dam	6.40 ft


16
14
12
10
8
6
4
2
Stage ft above stream bed
Reach 1
overbank
Reach 2
Horn Pond
Outlet
Reach 3
1,000
2,000
Discharge cfs
Stage Discharge
Rating Curves
Salmon Falls River
S62?-11-11



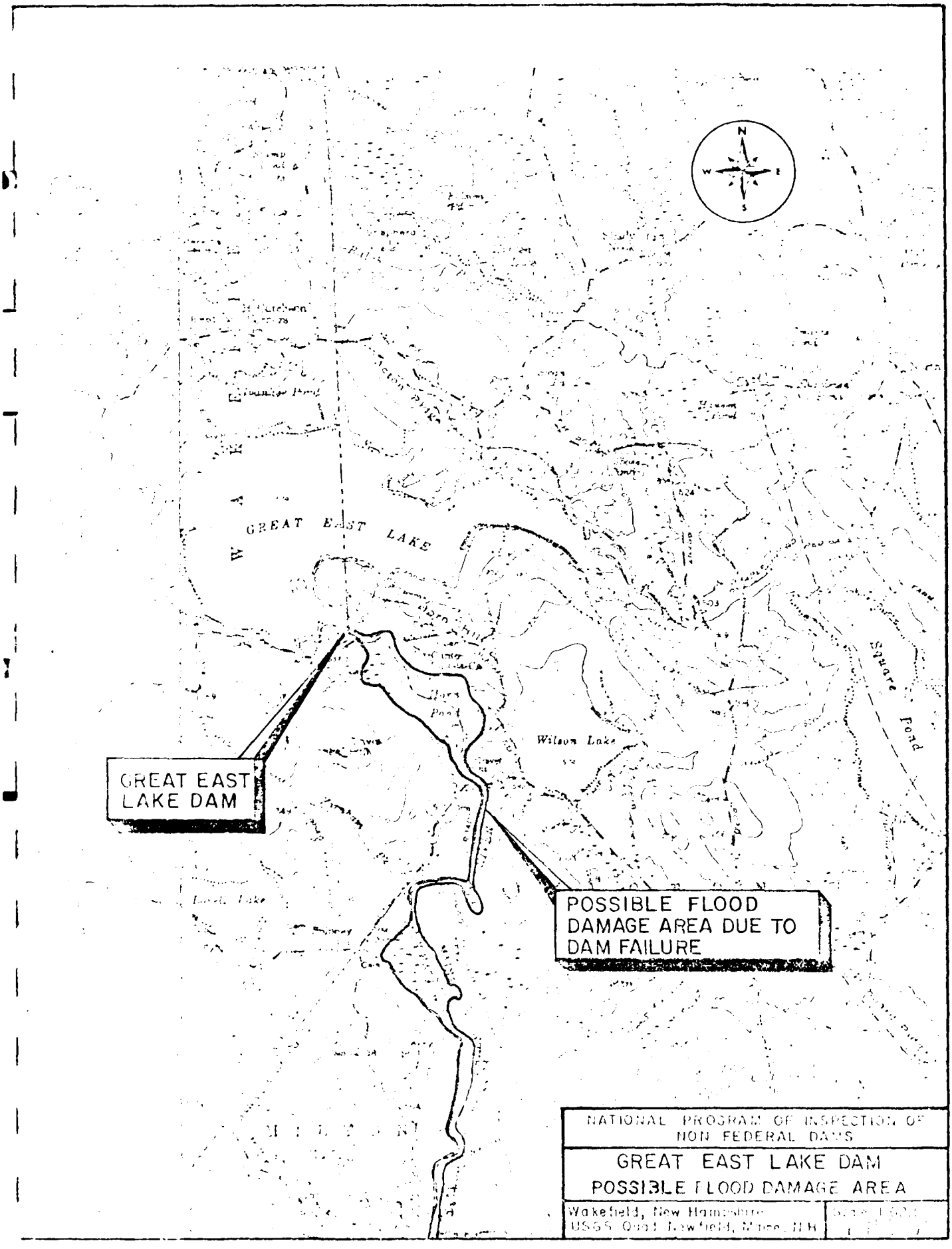
NATIONAL PROGRAM OF INSPECTION OF NON FEDERAL DAMS

GREAT EAST LAKE DAM

DRAINAGE AREA

Wakefield, New Hampshire
USGS Quad Newfield, Maine, NH

Scale: 1" = 2,000'


GREAT EAST LAKE
Wilson Lake
Square Pond
GREAT EAST LAKE DAM
POSSIBLE FLOOD DAMAGE AREA DUE TO DAM FAILURE
NATIONAL PROGRAM OF INSPECTION OF NON FEDERAL DAMS
GREAT EAST LAKE DAM
POSSIBLE FLOOD DAMAGE AREA
Wakefield, New Hampshire
USGS Quad Newfield, Maine-NH

APPENDIX E

INFORMATION AS CONTAINED IN THE NATIONAL INVENTORY OF DAMS

INVENTORY OF DAMS IN THE UNITED STATES

END

FILMED

8-85

DTIC